NAME _____ DATE _____ CLASS _____

VISCOSITY 3

Viscosity is the resistance of a fluid to flow. Fluids are liquids and gases. A viscous fluid has a high viscosity; that is, it does not flow easily. A less viscous fluid flows more easily.

Viscosity is a physical property of a fluid. In this experiment you will drop a BB through a fluid. The time it takes a BB to fall through the fluid is a measure of the fluid's viscosity. You will also determine how the concentration of a liquid affects its viscosity.

Objectives

In this experiment, you will

- measure the time for a BB to fall through a fluid,
- relate this time to the fluid's viscosity, and
- relate the concentration of a liquid to its viscosity

Equipment

- 11 BBs
- masking tape
- 96-well microplate
- 6 small plastic cups
- plastic microtip pipet
- stopwatch or timer
- 11 clear plastic soda straws
- corn syrup
- glycerol
- corn syrup or glycerol solution, unknown concentration
- distilled water

Procedure

Part A—Viscosities of Corn Syrup Solutions

1. Place the 96-well microplate on a flat surface with the numbered columns at the top and the lettered rows to the left.
2. Place 5 soda straws in wells C1 to C5 of the microplate as shown in Figure 3-1. The soda straws must fit tightly into the wells of the microplate. If they do not fit snugly, wrap the bottoms of the straws with masking tape.

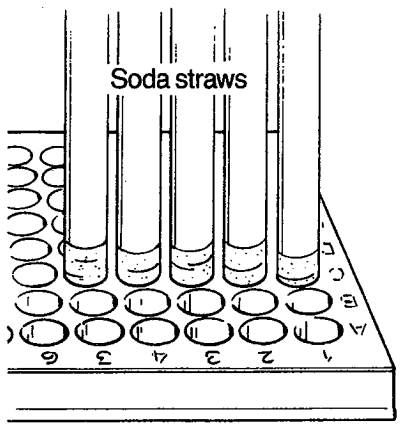


Figure 3-1.

3. Using the thin-stem pipet, fill the straw in well C1 with corn syrup.
4. Place 3 full pipets of corn syrup in a plastic cup. Rinse the pipet with water. Add 3 full pipets of distilled water to the cup. Gently shake the cup until the corn syrup is completely dissolved. Fill the soda straw in well C2 with this solution. Rinse the pipet with water.

5. Place 2 full pipets of corn syrup in another plastic cup and rinse the pipet. Add 4 full pipets of distilled water. Shake the cup to dissolve the corn syrup. Fill the soda straw in well C3 with this solution. Rinse the pipet.
6. Place 1 full pipet of corn syrup in a third plastic cup. Rinse the pipet and add 4 full pipets of distilled water to the cup and shake it to dissolve the corn syrup. Fill the soda straw in well C4 with this solution. Rinse the pipet.
7. Use the pipet to fill the straw in well C5 with distilled water.
8. Hold a BB slightly above the straw in well C1. Drop the BB and measure the time for the BB to fall to the bottom of the straw.
9. Record the time in Table 3-1.
10. Repeat steps 8 and 9 for the straws in wells C2 to C5.

Part B—Viscosities of Glycerol Solutions

Repeat steps 1–10 of Part A, using glycerol instead of corn syrup.

Part C—Unknown Concentration of Corn Syrup or Glycerol Solution

1. Your teacher will give you a sample of a solution of corn syrup or glycerol.
2. Place the last soda straw tightly into well C6. Use the pipet to fill the straw with the sample.
3. Drop a BB into the straw and measure the time for it to fall to the bottom of the straw.
4. Record the time in Table 3-1.
5. Using your data table, predict the concentration of the sample solution and record it in the Data and Observations section.

Analysis

1. Make a graph of your data from Part A using Graph 3-1. Label the x axis *Concentration (%)* and the y axis *Time (s)*. Plot the times for the BBs to fall to the bottom of the straws. Connect the points with a smooth line.
2. Using a different colored pencil, plot the data for Part B on the same graph and connect the points with a smooth line.
3. Refer to the appropriate graph for the sample solution that you used in Part C. Using the time measurement for the sample, read the value of concentration of the solution from the graph. Record the value in the Data and Observations section.

Conclusions

1. How is the time needed for a BB to fall through a fluid related to the fluid's viscosity?

_____

_____

2. What happens to the viscosity of a solution as its concentration decreases? _____

_____

3. How does your predicted value for the concentration of the solution used in Part C compare with the value that you determined from the graph? _____

_____

NAME _____ DATE _____ CLASS _____

4. Why are both the value of the concentration you predicted from your data table and the value you determined from the graph predicted values? _____

_____

5. Which of your two values of the concentration was a better prediction? Why?

_____

_____

Going Further

The Society of American Engineers (SAE) has devised a system of classifying petroleum oils by viscosity. Repeat this experiment with several different SAE-grade oils. What is the relationship between the SAE grade and viscosity?

Discover

What are the uses of viscous fluids? Use available resource materials to prepare a report describing how and why high-viscosity liquids and gases are used.

Data and Observations

Table 3-1

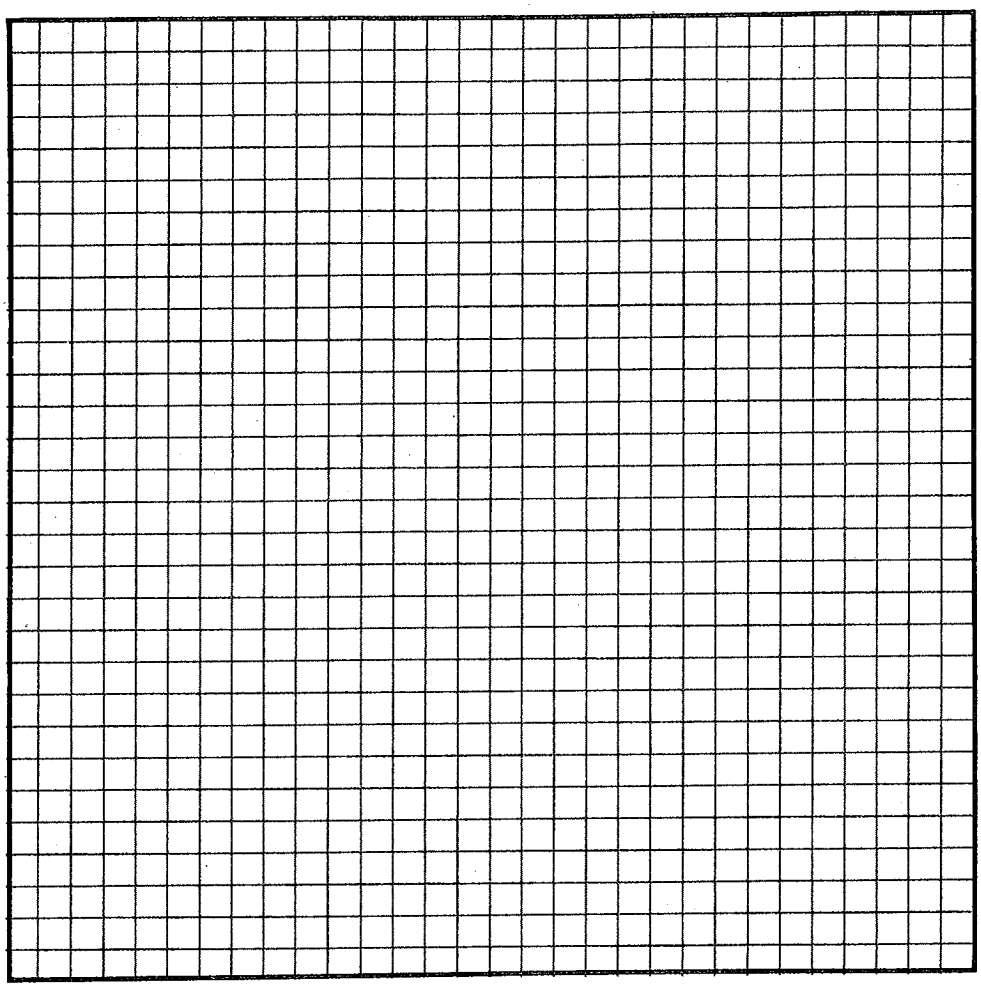
Well	Concentration (%)	Time for BB to fall through liquid(s)	
		corn syrup	glycerol
C1	100		
C2	50		
C3	33		
C4	20		
C5	0		
C6	Sample		

Predicted concentration of sample used in Part C: _____

_____

Concentration of sample determined from graph: _____

_____



Graph 3-1.